

# Social Network Analysis for National Security

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# SNA for COIN

- “COIN operations require assessing the political and social architecture of the operational environment, from both friendly and enemy perspectives. SNA can help commanders understand how an insurgent organization operates. Insurgent networks often do not behave like normal social networks. However, SNA can help commanders determine what kind of social network an insurgent organization is. That knowledge helps commanders understand what the network looks like, how it is connected, and how to best defeat it.”

# Outline

- Introduction to Social Network Analysis
- Social Networks in the US Army/Marine Counterinsurgency Field Manual
- Requests for research

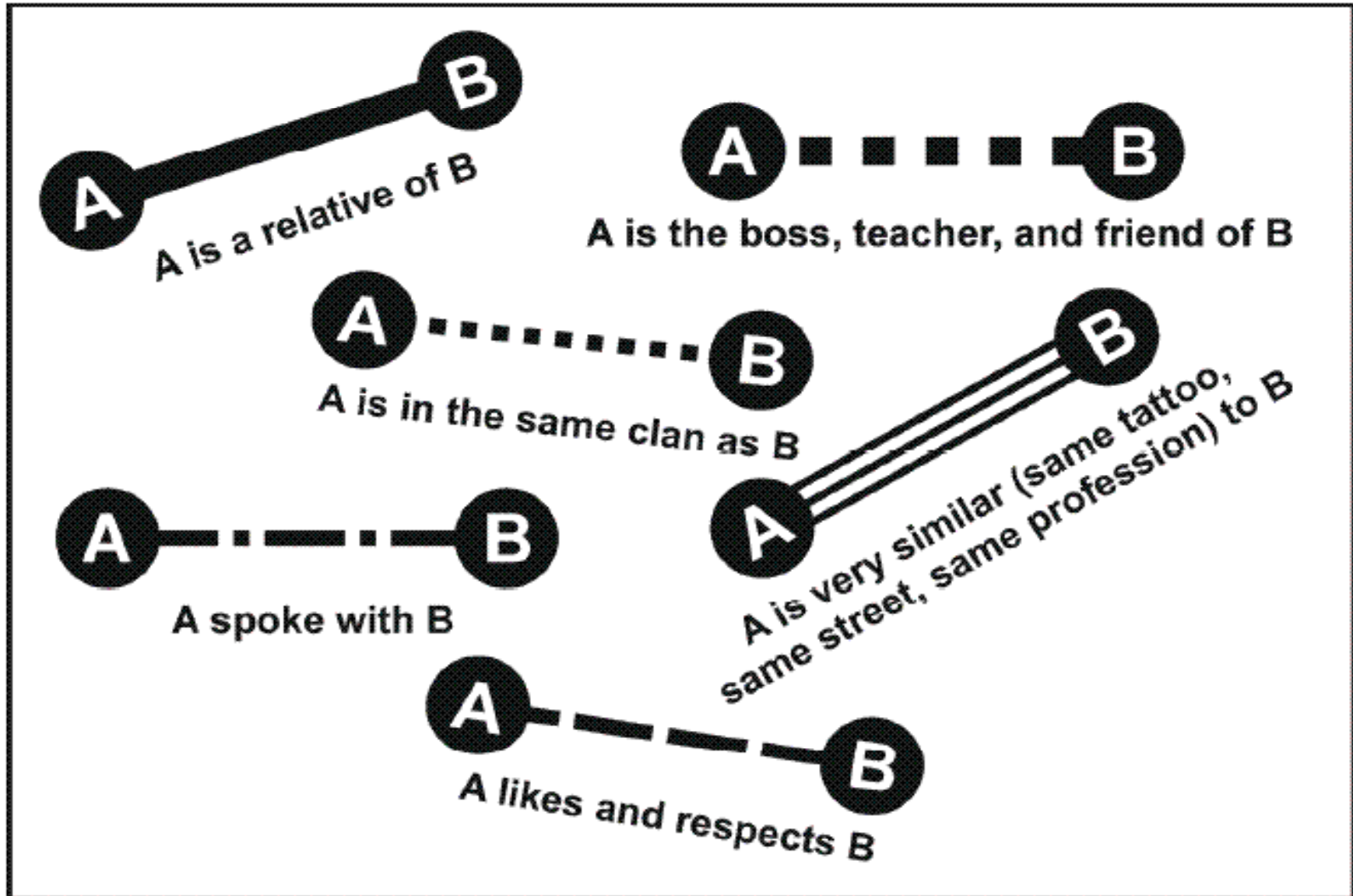
# Social Network Definition

- Graph, defined by nodes and edges
  - Nodes are actors
    - People, nations, organizations...
    - NOT Elephants
  - Edges indicate a relationship
    - Bidirectional: A knows B, A communicates with B
    - Directed: A gives orders to B, A knows of B
    - Which is “A is a friend of B?”

# Measures (not exhaustive)

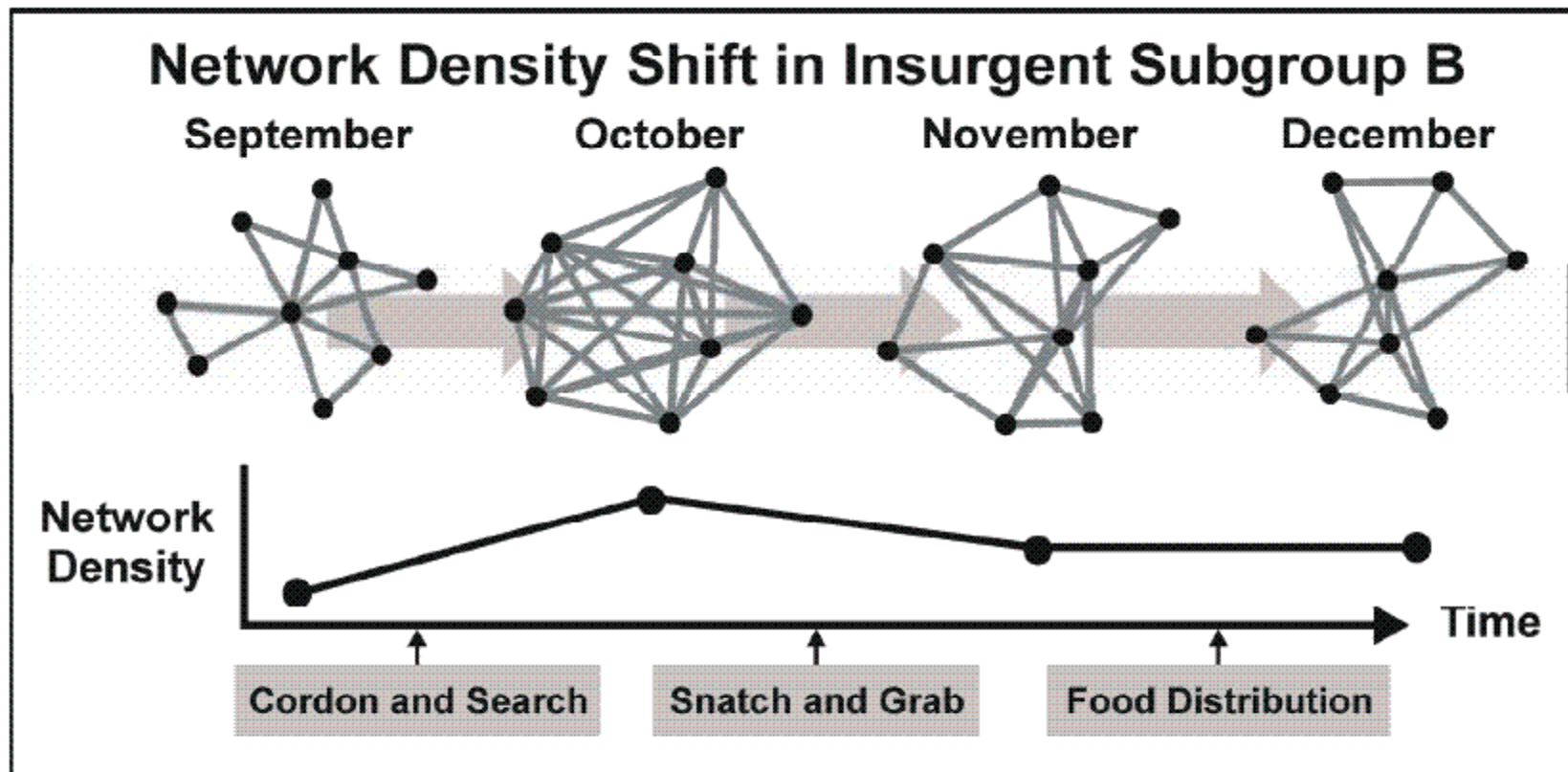
- Density
  - Proportion of possible edges that exist
- Betweenness centrality
  - Number of shortest paths containing an edge
- Centrality, in-degree/out-degree
  - Number of neighbors, or connections going in/out
- Other graph measures
  - # components, diameter, average distance,...

# Types of Connections



# Time-Varying Social Network

- Dense networks are dangerous networks
- Dense networks are vulnerable network





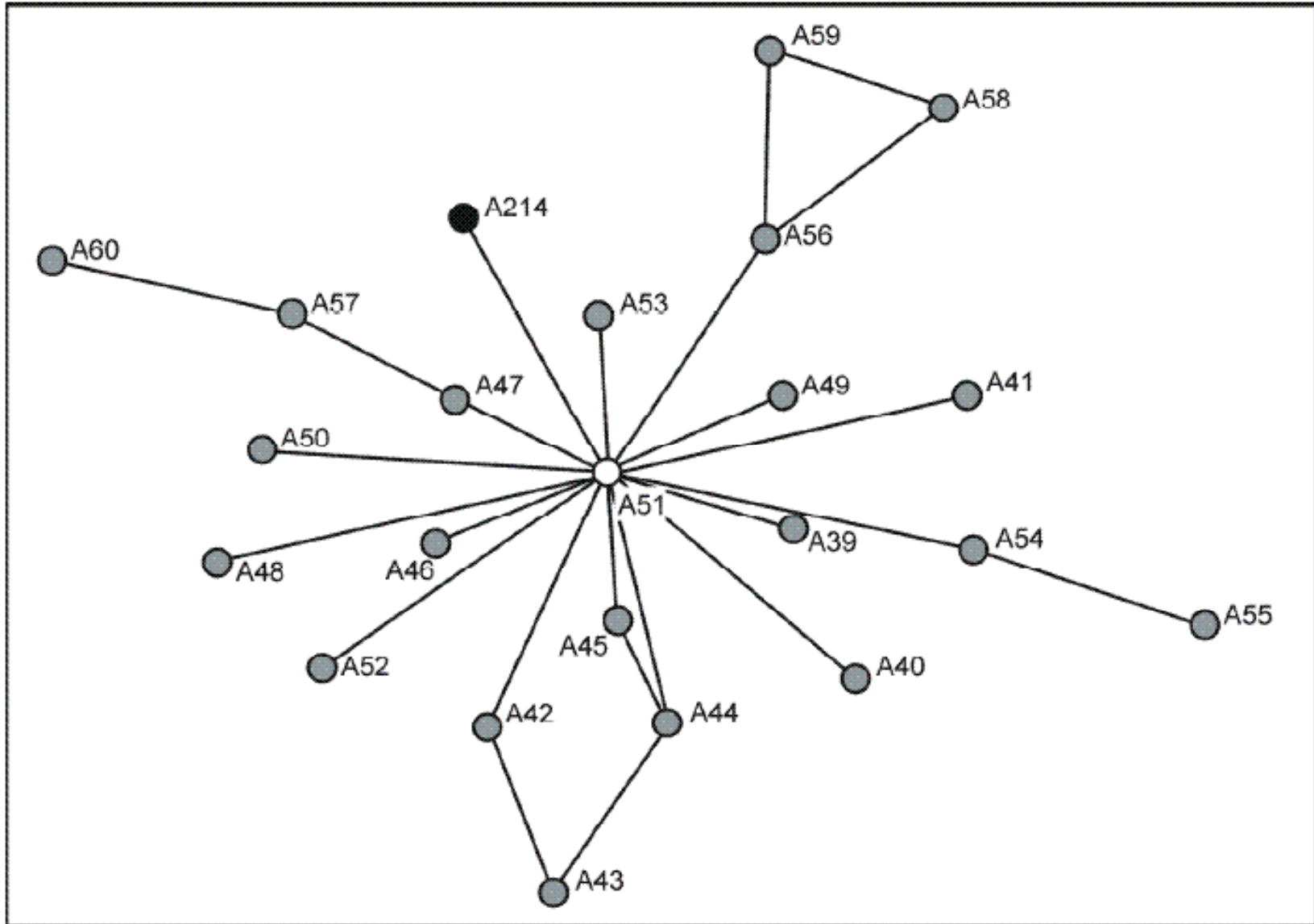
# Capture of Hussein

- “The intelligence analysts and commanders of the 4<sup>th</sup> Infantry Division spent the summer of 2003 building link diagrams showing everyone related to Hussein by blood or tribe. Those family diagrams led to the lowest level, but nonetheless highly trusted, relatives and clan members harboring Hussein and helping him move around the countryside...”

# Capture of Hussein

- “...Late in the year, a series of operations produced an abundance of new intelligence about the insurgency and Hussein’s whereabouts. Commanders then designed a series of raids to capture key individuals and leaders of the former regime who could lead counterinsurgents to him. Each mission gained additional information, which shaped the next raid...eventually leading coalition forces into Hussein’s most trusted inner circle and finally to Hussein’s capture.

# Saddam's Network (simplified)



# Requirements

- Scalable
  - Full Hussein network **much** larger
- Automated
- **Easy to understand**
  - Most users not in the math community
  - Be sure measures are well-named!
  - Methods with good lay explanations will be used

# Wish List

- Models for dynamic social networks
  - SAMSI has looked at this
- Networks with different types of ties
  - Layered networks?
  - Links inform each other – how do we leverage this information?
  - Similarity measures?

# Wish List

- Birth/death of links
  - Kinship permanent
  - Marriage rarely changes
  - “Buys from” transitory
- Characterize different life cycles
- Differences between types of links
  - An instance of an order different from “gives orders to”

# Wish List

- Principled framework for data-driven inference
  - Sparsely occurring links vs. death of links
  - How many orders -> Gives orders to?
    - Do I give orders to waiters?
    - I “task” my coworkers. Do I give them orders?
- Related fields – can we automate link detection from other data sources?

# Graphs as Statistics vs. Statistics on Graphs

- Current paradigm:
  - Graph is given
  - Statistics are functions of graph
  - Draw inference from graph
- My thought:
  - Graph summarizes data – it is a statistics, inferred from data.
  - Functions of graph project to lower dimensions, analogous to PCA